1. (c). nonlinear and time-invariant
2. (b). linear and not time-invariant
3. (c). not stable and causal
4. (a). stable and causal
5. (e). \( 0.7\pi = 2\pi(7/20) \)
6. (d). \( 0.7\pi = 2\pi(7/20) \) and \( \frac{2}{15}\pi = 2\pi(1/15) \) and LCM(20,15) = 60.
7. (c). \( 270\pi/50 = 27\pi/5 \equiv -3\pi/5 = -30\pi/50 \)
8. (c). \( x[n] = x(n/50) \cdot \sin(50\pi n/50) = 0 \) and \( \cos(270\pi n/50) = \cos(30\pi n/50) \rightarrow \text{ideal} \rightarrow \cos(30\pi t) \).

9. (f). The highest frequency component is \( 100+50 = 150 \) Hz, so we must sample at a rate higher than twice that, or \( f_s > 300 \) Hz.
10. (f). in the absence of aliasing: \( 4\sqrt{2}\cos(2\pi 10t - 3\pi/4) + 2\cos(30\pi t + \pi/3) \) or in the presence of aliasing, possibly: \( 4\sqrt{2}\cos(2\pi 50t - 3\pi/4) + 2\cos(30\pi t + \pi/3) \)
11. (c). Only the components at \( \pm 3\pi/4 \) remain, and \( 1^2 + 1^2 = 2 \).
12. (b). \( 2\cos\left(\frac{4}{3}\pi n\right) = 2\cos\left(-\frac{2}{3}\pi n\right) = 2\cos\left(\frac{2}{3}\pi n\right) = e^{\frac{2}{3}\pi n} + e^{-\frac{2}{3}\pi n} \).
13. (d). \( X[k] = \frac{1}{4} \left[ 4 + 8e^{-\frac{2\pi}{3}k} + 8e^{-\frac{2\pi}{3}2k} + 8e^{-\frac{2\pi}{3}3k} \right] = 1 + 2(-1)^k + 4\cos\left(\frac{\pi}{3}k\right) = \{\bar{2}, -1, -1\} \).
14. (e). The 3-point DFT of \( x[n] \) is \( X[k] = \frac{1}{3} \left[ 3 + 6e^{-\frac{2\pi}{3}k} + 6e^{-\frac{2\pi}{3}2k} \right] = 1 + 4\cos\left(\frac{2\pi}{3}k\right) = \{\bar{2}, -1, -1\} \).
So \( x[n] = 5 - e^{\frac{2\pi}{3}n} - e^{\frac{2\pi}{3}2n} = 5 - 2\cos\left(\frac{2\pi}{3}n\right) \).
Alternatively, plug \( n = 0 \) into the various answers; only (e) gives the correct value \( x[0] = 3 \).

15. (f). \( D = X[3] = \frac{1}{4} \left[ 30 + 20e^{-\frac{\pi}{3}} + 10e^{-\frac{\pi}{3}3} + 0 \right] = \frac{1}{4} [30 + 20j - 10] = 5 + 5j \)
16. (f). \( \sum_k |X[k]|^2 = 9 \)
17. (a). \( x[n] = \delta[n] + 2\delta[n-2] \Rightarrow y[n] = x[n] + x[n-2] = \delta[n] + 2\delta[n-2] + 2\delta[n-2] + \delta[n-4] \).
18. (b). Cascades of LTI systems are LTI; cascades of FIR systems are FIR, cascades of causal systems are causal, and all FIR systems are stable.
19. (a). \( (\delta[n] + \delta[n-2]) * (\delta[n] + 2\delta[n-1]) = \delta[n] + 2\delta[n-1] + \delta[n-2] + 2\delta[n-4] \).
20. (d). \( y[n] = x[n] + x[n-2] = \cos(\pi n) + \cos(\pi (n-2)) = \cos(\pi n) + \cos(\pi n) = 2\cos(\pi n) \).
Section 001: 69 students, mean=78.2, median=80, std=17.1
Section 002: 71 students, mean=72.5, median=80, std=20.2
EECS 398 (AOSS): 18 students, mean=60.0, median=57.5, std=18.6
Combined 206: 140 students, mean=75.3, median=80, std=18.9
Section 001 histogram:

Section 002 histogram:

Combined histogram:

For elaboration on these solutions, please come to office hours.